# $\mu$SR Study of unconventional Organic Superconductor $\kappa$-(BEDT-TTF)$_4$Hg$_{2.89}$Br$_8$

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The organic salts, $\kappa$-(BEDT-TTF)$_2X$ ($X$ = anion), can be regarded as band width-controlled superconductors with the half-filled band. Among the $\kappa$-type salts, $\kappa$-(BEDT-TTF)$_4$Hg$_{2.89}$Br$_8$ (hereafter abbreviated to $\kappa$-Hg$_{2.89}$Br$_8$) shows a unique incommensurate structural characteristic not seen in other $\kappa$-type salts[1]. Due to this incommensurability, hole-doped state may be realized in $\kappa$-Hg$_{2.89}$Br$_8$ and this salt shows superconductivity at 4.2 K. Upper critical field of this salt is anomalously larger than Pauli limit value. Further electrical resistance in the normal state shows linear dependence on temperature at low temperatures, which is characteristic of non-Fermi liquid systems[2]. From these measurements, unconventional superconductivity is expected in $\kappa$-Hg$_{2.89}$Br$_8$. In order to clarify the superconducting properties of $\kappa$-Hg$_{2.89}$Br$_8$, we measured ZF-$\mu$SR to investigate whether the superconducting phase at ambient pressure violates the time-reversal symmetry or not. Moreover, we measured the muon Knight shift to investigate the microscopic magnetic property of $\kappa$-Hg$_{2.89}$Br$_8$ in the normal state.

Zero field $\mu$SR spectra of $\kappa$-Hg$_{2.89}$Br$_8$ are fitted by the product of the temperature independent Kubo-Toyabe function and the exponential function. The relaxation rate $\lambda$ of the exponential function increases with decreasing temperature and becomes almost temperature-independent below 10 K. No anomaly is found at the superconducting transition temperature, 4.2 K. This result suggests that the superconducting phase in $\kappa$-Hg$_{2.89}$Br$_8$ does not break the time-reversal symmetry.

The muon Knight shift at 6 T obeys Curie-Weiss behavior down to 2 K. Static magnetic susceptibility, however, shows a peak around 30 K and a rapid decrease at low temperatures. It is interesting to note that $1/T_1T$ measured by $^{13}$C-NMR [3] also shows Curie-Weiss behavior down to 10 K and does not show a maximum. Origin of discrepancy between macroscopic measurements and microscopic ones is not clear at present and further study is needed.

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[2] H. Taniguchi *et al.*, J. Phys. Soc. Jpn., 76 (2007) 113709.
[3] K. Miyagawa *et al.*, unpublished.